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## **PERFORATION DEVICE**

### **RELATED APPLICATION**

5 This is a continuation application which claims priority under 35 U.S.C. §120 to commonly-owned, co-pending U.S. Patent Application Serial No. 09/029,549 entitled, "PERFORATION DEVICE", filed March 6, 1998, which is hereby incorporated by reference in its entirety.

### **BACKGROUND OF THE INVENTION**

10 The invention relates to a perforator for perforating a moving paper in its direction of movement. The invention can for instance be implemented in the perforation of paper sheets printed out from a printer.

### **DESCRIPTION OF THE RELATED PRIOR ART**

15 Letter sheets often have a section defined with perforation, which the receiver can tear off. The perforated parts are frequently forms such as bank transfer slips or reply forms. Such letters are typically printed out in large series and inserted in mailing envelopes by mechanical means.

20 Letters of the kind above can be printed out on preperforated paper. In that case, different paper qualities will be required if unperforated sheets are desired. In addition, the perforation will always be in the same place of the sheet, and thus there will be limitations on the layout of the printout. If a perforated paper web is fed from a reel to be printed out, each sheet will have a perforation, whether desired or not.

25 There are perforators connected to printers, which perforate paper in the direction of movement. These also have the drawback of providing each sheet with a perforation. Patent specification EP A 658406 discloses such a device, which allows the length of the perforation and its position on the sheet to be regulated in advance. Yet this device will also provide each sheet with similar perforation.

### **SUMMARY OF THE INVENTION**

30 A perforator as defined in claim 1 has now been invented. The remaining claims describe a number of preferred embodiments of the invention.

The essential feature of the invention is that perforation in the direction of movement can be performed under control, limited to a specific distance, and on selected sheets. Moreover, the perforation may be given the desired length on each sheet.

5 The device has a perforating tool, which can be controllably set in perforating position or neutral position, in which perforation is not performed. In practical operation, this can be done by making the distance of the perforating tool to the moving paper variable, so that the tool either touches the paper, producing a perforation, or is at a distance from the paper, so that no perforation is produced.

10 In the preferred embodiment the device comprises a perforating tool that is movable relative to the paper. The tool can be moved in any suitable manner, pneumatically for instance.

The tool control apparatus may be preprogrammed to receive a signal from the printer output data or by reading a code on the paper by means of a reader.

15 The transverse position of the perforating tool is preferably adjustable. This allows the perforation to be positioned in the desired place in each case.

There may also be several, for instance two perforating tools. This allows a corresponding number of perforations, e.g. two perforations, to be performed simultaneously.

The perforation may be performed after or before printing. The device may be firmly connected to the printer or separate from it.

20 The arrangement in accordance with the invention allows the same paper to be consistently used in the printer, while perforation is nevertheless performed selectively on the desired sheets alone. This yields a particular advantage when perforation is needed only on specific pages of printout letters with many pages.

25 The device in accordance with the invention enables high printout speeds to be obtained.

### BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings pertain to the special description of the invention. In the drawings

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- figure 1 is a schematic view of the perforation process;
  - figure 2 shows a printout unit to which a perforation unit has been connected;
  - figure 3 illustrates selective perforation of a letter with many pages; and

- figure 4 is a front view of the perforation unit.

### DETAILED DESCRIPTION OF THE INVENTION

In the configuration in figure 1, paper sheets 1 pass through perforation unit 2, where  
5 the paper is perforated in the travel direction if needed. The perforation unit includes a  
perforating disc 3 rotating in the direction of movement of the paper and an opposing roll 4, the  
paper running between these two. The perforating disc is vertically movable such that it can be  
brought into contact with the paper, producing perforation, or kept apart from the paper, so that  
no perforation is produced.

10 In the first step in figure 1, paper 1 is about to enter perforation unit 2. If the paper is to  
be perforated, the actuator of the perforation unit is given a signal to lower perforation disc 3  
for the time the paper passes in front of the disc (step 2). Thus a perforation 5 in the direction  
of movement is produced on the paper. When the paper has passed by the disc, the disc will  
automatically rise to its upper position (step 3). If no perforation is desired, the perforation unit  
15 is not given any signal the paper passing then through the unit with the perforation disc  
constantly at a distance from the paper.

Figure 2 illustrates a configuration where perforating unit 2 is placed in printout unit 6.  
In this, paper is taken from reel 7, is cut into sheets 1 and the desired message is printed on the  
sheets with printer 8. The printout is controlled by means of computer 9 and control unit 10. If  
20 perforation is desired on the sheet, a signal 11 is emitted from the control unit to the perforation  
unit. The perforated sheets are stacked in a pile 12 and transferred to a mailing machine, for  
instance.

The printout unit in figure 2 can also be used to prepare serial letters comprising several  
sheets 1. Thanks to the selective perforation, the desired perforation is obtained just on the  
25 intended pages. Figure 3 is a schematic view of a process where perforation 5 is performed on  
the second and fourth page of a four-page letter.

Figure 4 is a front view of a perforation unit 2. It includes two rotatable perforating  
discs 3 with opposing rolls 4. The pairs of disc/roll can be moved in the transverse direction.  
Each of the perforating discs is connected with an independently controlled, pneumatically  
30 operating shifting apparatus 13, by means of which the disc can be lowered into perforating  
position, if desired. In normal operation, the disc is in upper position. If the sheet 1 passing  
underneath is to be perforated, the shifting apparatus is given a pulse, and then the disc is

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pressed against the sheet over the desired period such that a perforation with the desired length is produced. Such a perforation unit has a capacity of over 30,000 perforated sheets per hour.

The opposing roll 4 of perforation disc 3 is flat i.e. it has no groove matching the disc. In this manner, there will be no relief on the paper, which could hamper any further handling of the paper.

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